JAN 19 1990

FLOOD INSURANCE STUDY

PAULDING COUNTY, OHIO
UNINCORPORATED AREAS

DECEMBER 5, 1989

Federal Emergency Management Agency

COMMUNITY NUMBER - 390777

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

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FLOOD INSURANCE STUDY

PAULDING COUNTY,
UNINCORPORATED AREAS,
OHIO

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the Unincorporated Areas of Paulding County, Ohio, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and assist the community in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the State (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by the U.S. Army Corps of Engineers (COE), Buffalo District, (the Study Contractor) for the Federal Emergency Management Agency (FEMA), under Inter-Agency Agreement No. EMW-86-E-2226, Project Order No. 16. This study was completed in September 1987.

1.3 Coordination

On October 29, 1985, an initial time and cost meeting was held between representatives of FEMA, the Ohio Department of Natural Resources (ODNR), Paulding County, the U.S. Soil Conservation Service (SCS), and the Study Contractor. The streams to be studied were determined.

On November 28, 1988, the results of this Flood Insurance Study were reviewed and accepted at a final coordination meeting attended by representatives of the Study Contractor, FEMA, and the community.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the unincorporated areas of Paulding County, Ohio. The area of study is shown on the Vicinity Map (Figure 1). The incorporated areas within the county were excluded from this study.

Flooding caused by overflow of the Auglaize River and Flatrock Creek was studied in detail.

Areas having low development potential or minimal flood hazards were previously studied using approximate analyses. The results were shown on the Flood Hazard Boundary Map for Paulding County, Ohio (Reference 1) and are incorporated into this Flood Insurance Study.

The areas studied were selected with priority given to all known flood hazard areas and areas of projected development or proposed construction through September 1992. The scope and methods of study were proposed to and agreed upon by FEMA and Paulding County.

2.2 Community Description

Paulding County is in northwestern Ohio and is bordered on the west by Allen County, Indiana, on the north by Defiance County, Ohio, on the east by Defiance and Putnam Counties, Ohio and on the south by Van Wert County, Ohio. Paulding County is served by State Routes 49, 66, 111, and 613, U.S. Route 27, the Norfolk Southern Railway, and Conrail. The 1980 population of Paulding County was reported to be 21,302 (Reference 2). Paulding County is primarily rural.

The climate of Paulding County is continental, characterized by moderate variations of temperature and precipitation. The maximum temperature recorded at the Village of Paulding Climatological Data Station was 102 degrees Fahrenheit (^{o}F) in September 1953, and the minimum of -19^{o}F was recorded in January 1972. The maximum recorded 24-hour rainfall was 6.39 inches on September 14, 1972, and the maximum recorded 24-hour snowfall was 12.0 inches on December 20, 1973 (Reference 3).

2.3 Principal Flood Problems

Areas in the vicinity of the Village of Paulding have experienced flooding from Flatrock Creek on several occasions. In the winter of 1959 and in the Spring of 1982, flooding attributed to ice jamming concurrent with rainfall and snowmelt on frozen ground occurred in those areas. Photographs of the 1959 flood are available at the Paulding County offices, but very little descriptive information is available. During the March 1982 flood, U.S. Route 127 was blocked near its crossing with Flatrock Creek and there was 2.5 to 3 feet of water over the road. This flooding was attributed to ice jamming at the Jackson Street and U.S. Route 127 bridges. The same floodwaters inundated Emerald Avenue, State Route 111, Caroline Street near Main Street, and Paulding High School.

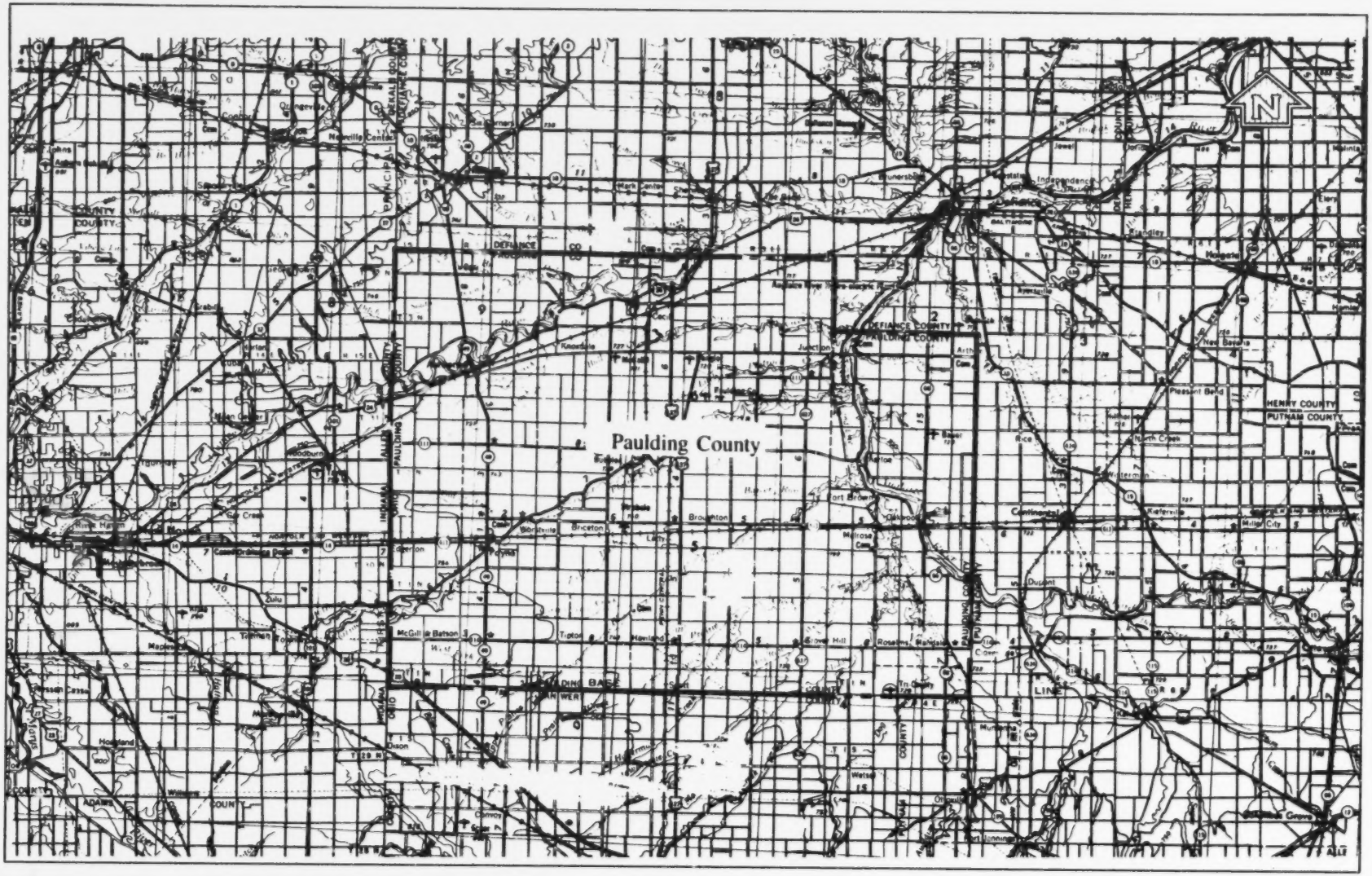


FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

PAULDING COUNTY, OH
(UNINCORPORATED AREAS)

APPROXIMATE SCALE

6 0 6 12 18 MILES

VICINITY MAP

In February 1985, a less severe flood inundated Emerald Avenue at Caroline Street, the land between U.S. Route 127 and Jackson Street, and the property along Water Works Road behind Paulding County Hospital. The basement of Paulding High School was also flooded as a result of sewer backup (Reference 4).

Because the majority of Paulding County is rural, other floods are not well documented. Although the March 1913 flood of the Maumee River was the worst known to have occurred in that river basin, there is no detailed description of that flood. Flooding problems along Flatrock Creek at the Village of Payne and along the Auglaize River are not well documented, but it would be safe to assume that flooding occurred on those streams during the same periods that flooding occurred near the Village of Paulding.

Reliable estimates of return intervals for the 1959 and 1982 floods cannot be made because there are no gage records or high-water marks available. Because the floods were a combination of rainfall and snowmelt, it is not possible to use rainfall frequency analysis.

2.4 Flood Protection Measures

Flood protection measures are not known to exist within the study area.

The Paulding Dam is located on Flatrock Creek within the City of Paulding, but does not provide protection to the county from major events such as the 100-year flood.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude that is expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood that equals or exceeds the 100-year flood (1-percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each riverine flooding source studied in detail affecting the community.

The discharges for Flatrock Creek were established using the regression equations in Ohio Bulletin No. 45 (Reference 5). Basin characteristics, such as drainage area and channel slope, were determined using topographic maps (Reference 6). Average annual precipitation values were taken from Bulletin No. 45.

The only gage on the Auglaize River in the study area is near the City of Defiance, about 1,500 feet downstream of the border between Defiance and Paulding Counties. The drainage area for the gage is 2,318 square miles. The discharge-frequency curve used for determining the 100-year discharge of the Auglaize River was developed from data at this gage. The data were analyzed in accordance with criteria outlined in Bulletin No. 17B (Reference 7). The drainage area of the Auglaize River in the study area is 2,256 square miles. Because that figure is within 5 percent of the drainage area of the gage, the 100-year peak discharge at the gage is applicable for this study.

Peak discharge-drainage area relationships for the 100-year floods of each flooding source studied in detail in the community are shown in Table 1.

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQ MILES)	PEAK DISCHARGE (CFS) 100-YEAR
AUGLAIZE RIVER		
at downstream county boundary	2,256	70,700
FLATROCK CREEK		
about 0.5 mile downstream of confluence of Opossum Run	168.4	5,920
about 1 mile downstream of Sitzler Road	135.4	5,200

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Cross-section data for the streams and overbank areas were obtained by field survey and from topographic maps (Reference 6). Bridges were surveyed to obtain elevation data and structural geometry.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles and on the Flood Insurance Rate Map.

Roughness coefficients (Manning's "n") and contraction and expansion loss coefficients used in the hydraulic computations were chosen by engineering judgment and based on field observation of the streams and the floodplain areas. The values used for the streams studied are listed below.

ROUGHNESS COEFFICIENTS

	MANNING'S "N"			
STREAM	CHANNEL	OVERBANK	CONTRACTION LOSS	EXPANSION LOSS
AUGLAIZE RIVER	0.035	0.07	0.1-0.3	0.3-0.5
FLATROCK CREEK at Paulding	0.045-0.048	0.05-0.08	0.1-0.3	0.3-0.5
FLATROCK CREEK at Payne	0.03-0.05	0.04-0.09	0.3-0.4	0.5-0.7

Water-surface profiles were developed using the HEC-2 step-backwater computer program (Reference 8).

The starting water-surface elevation for Flatrock Creek was derived from normal depth calculations. The starting water-surface elevation for the Auglaize River was obtained from the rating curve developed for the Power Dam Corporation (Reference 9).

Flood profiles were drawn showing the computed water-surface elevations for floods of the selected recurrence intervals.

The hydraulic analyses for this study are based on the effects of unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in this study are shown on the map and described in the exhibit labeled Elevation Reference Marks.

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages state and local governments to adopt sound floodplain management programs. Therefore, each Flood Insurance Study provides 100-year flood elevations and delineations of the 100- and 500-year floodplain boundaries and 100-year floodway to assist communities in developing floodplain management measures.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1-percent annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. For each stream studied in detail, the 100- and 500-year floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:24000 with a contour interval of 5 feet (Reference 6).

The 100-year floodplain boundaries are shown on the Flood Insurance Rate Map. On this map, the 100-year floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A, AE, AH, AO, A99, V, and VE). Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

For the streams studied by approximate methods, only the 100-year floodplain boundary was delineated using the Flood Hazard Boundary Map for Paulding County (Reference 1).

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces the flood-carrying capacity, increases the flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 100-year floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodways for this study were computed for certain stream segments on the basis of equal conveyance reduction from each side of the floodplain. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations are tabulated for selected cross sections and are shown in Table 2, Floodway Data. The computed floodways are shown on the Flood Insurance Rate Map. In cases where the floodway and 100-year floodplain boundaries are either close together or collinear, only the floodway boundary is shown. Portions of the floodway for Flatrock Creek lie within the corporate limits of the Villages of Payne and Paulding.

Along streams where floodways have not been computed, the community must ensure that the cumulative effect of development in the floodplain will not cause more than a 1.0-foot increase in the base flood elevations at any point within the community.

The area between the floodway and the 100-year floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 2.

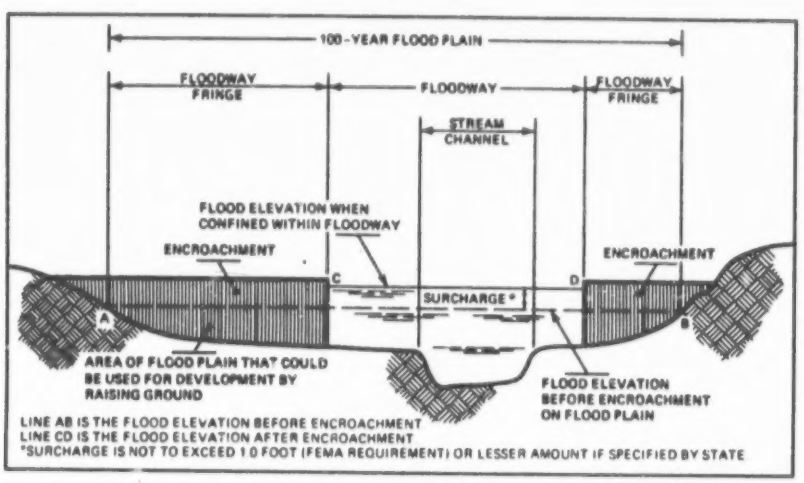

100-YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE AB IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE CD IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE IS NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE

FIGURE 2 - Floodway Schematic

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC.)	REGULATORY (FEET NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
AUGLAIZE RIVER								
A	47,980	806	18,507	3.8	702.3	702.3	702.5	0.2
B	50,400	1087	20,616	3.4	702.6	702.6	702.8	0.2
C	51,580	906	18,042	3.9	702.7	702.7	702.9	0.2
D	54,000	1111	23,812	3.0	703.2	703.2	703.5	0.3
E	58,400	1537	28,430	2.5	703.7	703.7	704.0	0.3
FLATROCK CREEK								
A	4060[2]	263	1346	4.4	715.1	715.1	715.7	0.6
B	7190[2]	635	4666	1.3	717.4	717.4	718.4	1.0
C	9200[2]	642	3958	1.5	717.7	717.7	718.7	1.0
D	16,090[2]	350	3633	1.6	720.8	720.8	721.7	0.9
E	17,439[2]	373[4]	2709	2.2	721.3	721.3	722.2	0.9
F	18,864[2]	367	2842	2.1	722.0	722.0	722.8	0.8
G	20,743[2]	179	1546	3.8	722.4	722.4	723.2	0.8
H	22,900[2]	352	4158	1.4	723.0	723.0	723.8	0.8
I	7875[3]	142	1270	4.1	738.3	738.3	739.2	0.9
J	10,615[3]	337	2577	2.0	740.3	740.3	741.0	0.7
K	16,065[3]	317[4]	1949	2.7	742.4	742.4	743.4	1.0
L	18,260[3]	250	2785	1.9	743.1	743.1	744.1	1.0
M	22,245[3]	322	2229	2.3	744.4	744.4	745.4	1.0

[1]FEET ABOVE MOUTH
[2]FEET ABOVE CONFLUENCE OF JOHNSON'S DITCH
[3]FEET ABOVE STATE ROUTE 613
[4]THIS WIDTH EXTENDS WITHIN AREA NOT INCLUDED

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

PAULDING COUNTY, OH
(UNINCORPORATED AREAS)

FLOODWAY DATA

AUGLAIZE RIVER—FLATROCK CREEK

5.0 INSURANCE APPLICATION

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

Zone A

Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations or depths are shown within this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by detailed methods. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 100-year floodplain, areas of 100-year flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No base flood elevations or depths are shown within this zone.

6.0 FLOOD INSURANCE RATE MAP

The Flood Insurance Rate Map is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 100-year floodplains that were studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols the 100-year floodplain, the floodways, and the locations of selected cross sections used in the hydraulic analyses and floodway computations.

7.0 OTHER STUDIES

A Special Flood Hazard Evaluation Report on Flatrock Creek in the Village of Paulding was completed by the COE (Reference 4) and is in agreement with this study.

The Flood Insurance Study published for the Village of Paulding, Ohio, (Reference 10) is in agreement with this study.

The Flood Insurance Rate Maps printed for the Villages of Antwerp, Oakwood, and Grover Hill are in agreement with this study (References 11-13).

Flood Insurance Studies are in progress for Defiance and Putnam Counties, Ohio and Allen County, Indiana (References 14-16) and are in agreement with this study.

This Flood Insurance Study supersedes the previously printed Flood Hazard Boundary Map for Paulding County (Reference 1).

8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, FEMA, 175 West Jackson Boulevard, 4th Floor, Chicago, Illinois 60604.

9.0 REFERENCES AND BIBLIOGRAPHY

1. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Hazard Boundary Map, Paulding County, Unincorporated Areas Ohio, June 1979.

2. U.S. Department of Commerce, Bureau of the Census, 1980 Census of Population, Number of Inhabitants, Ohio, Washington, D.C., February 1982.

3. ————, National Oceanic and Atmospheric Administration, Climates of the States, 1974.

4. U.S. Army Corps of Engineers, Buffalo District, Special Flood Hazard Evaluation Report, Flatrock Creek, Village of Paulding, Paulding County, Ohio, Buffalo, New York, August 1986.

5. Ohio Department of Natural Resources, Division of Water, Bulletin No. 45, Floods in Ohio, Magnitude and Frequency, E.E. Webber and W.P. Bartlett Jr., May 1977.

6. U.S. Geological Survey, 7.5 Minute Series Topographic Maps, Scale 1:24000, Contour Interval 5 Feet: Oakwood, Ohio, 1960, photorevised 1973; Paulding, Ohio, 1960, photorevised 1973; Latty, Ohio, 1960, photorevised 1973; Junction, Ohio, 1960, photorevised 1973; Payne, Ohio, 1960, photorevised 1973.

7. U.S. Department of the Interior, Geological Survey, Interagency Advisory Committee on Water Data, Office of Water Data Coordination, Hydrology Subcommittee, Bulletin No. 17B, Guidelines for Determining Flood Flow Frequency, September 1981, revised March 1982.

8. U.S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-2 Water Surface Profiles, Computer Program 723-X6-L202A, Davis, California, April 1984.

9. Protrans Consultants, Preliminary Report to Division of Water, ODNR, Supporting the Application for Permit for the Installing Flashboards Atop the Crest of the Dam at the Auglaize River, Mile 5.85, April 1987.

10. Federal Emergency Management Agency, Flood Insurance Study, Village of Pauling, Paulding County, Ohio, September 1988.

11. ————, Flood Insurance Rate Map, Village of Antwerp, Paulding County, Ohio, August 1985.

12. ————, Flood Insurance Rate Map, Village of Oakwood, Paulding County, Ohio, July 1988.

13. ————, Flood Insurance Rate Map, Village of Grover Hill, Paulding County, Ohio, August 1986.

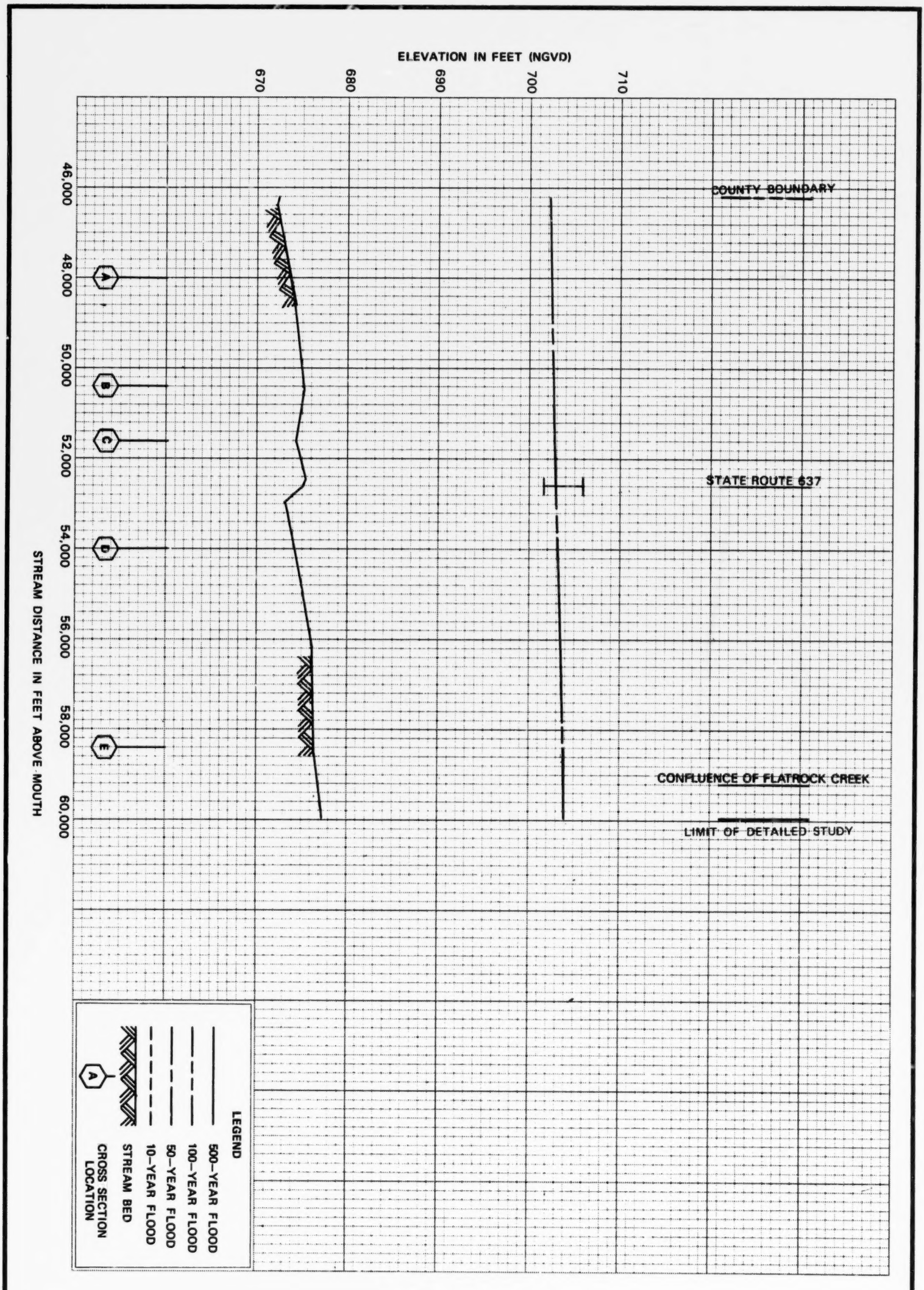
14. ————, Flood Insurance Study, Defiance County, Unincorporated Areas, Ohio, in progress.

15. ————, Flood Insurance Study, Putnam County, Unincorporated Areas, Ohio, in progress.

16. ————, Flood Insurance Study, Allen County, Unincorporated Areas, Indiana, in progress.

ELEVATION REFERENCE MARKS

REFERENCE MARK	FLOOD INSURANCE RATE MAP PANEL	ELEVATION (FEET NGVD)	DESCRIPTION OF LOCATION
1	0040	723.56	spike on top of downstream north abutment of abandoned railroad bridge over Flatrock Creek about 1,600 feet south of Fairgrounds Road, about 1,660 feet east of Paulding Dam
2	0040	725.71	chiseled cross on top of extreme end of south abutment of County Route 107 bridge over Flatrock Creek
3	0055	700.03	U.S. Geological Survey bench mark stamped "19 EDJ 1959" on west side of the Auglaize River at intersection of State Route 111, and County Route 171, about 4 feet east of northeast corner of wellhouse at Junction Bridge Park
4	0065	700.16	mark on nut on top of plate on southwest abutment of County Route 171 bridge over Flatrock Creek
5	0085	748.38	U.S. Coast and Geodetic Survey bench mark stamped "F315 1968" on southwest corner of upstream west abutment of Norfolk Southern Railway bridge over Flatrock Creek
6	0085	748.11	chiseled cross on extreme end of downstream east wingwall of State Route 49 bridge over Flatrock Creek



01P

FEDERAL EMERGENCY MANAGEMENT AGENCY

PAULDING COUNTY, OH
(UNINCORPORATED AREAS)

FLOOD PROFILES

AUGLAIZE RIVER

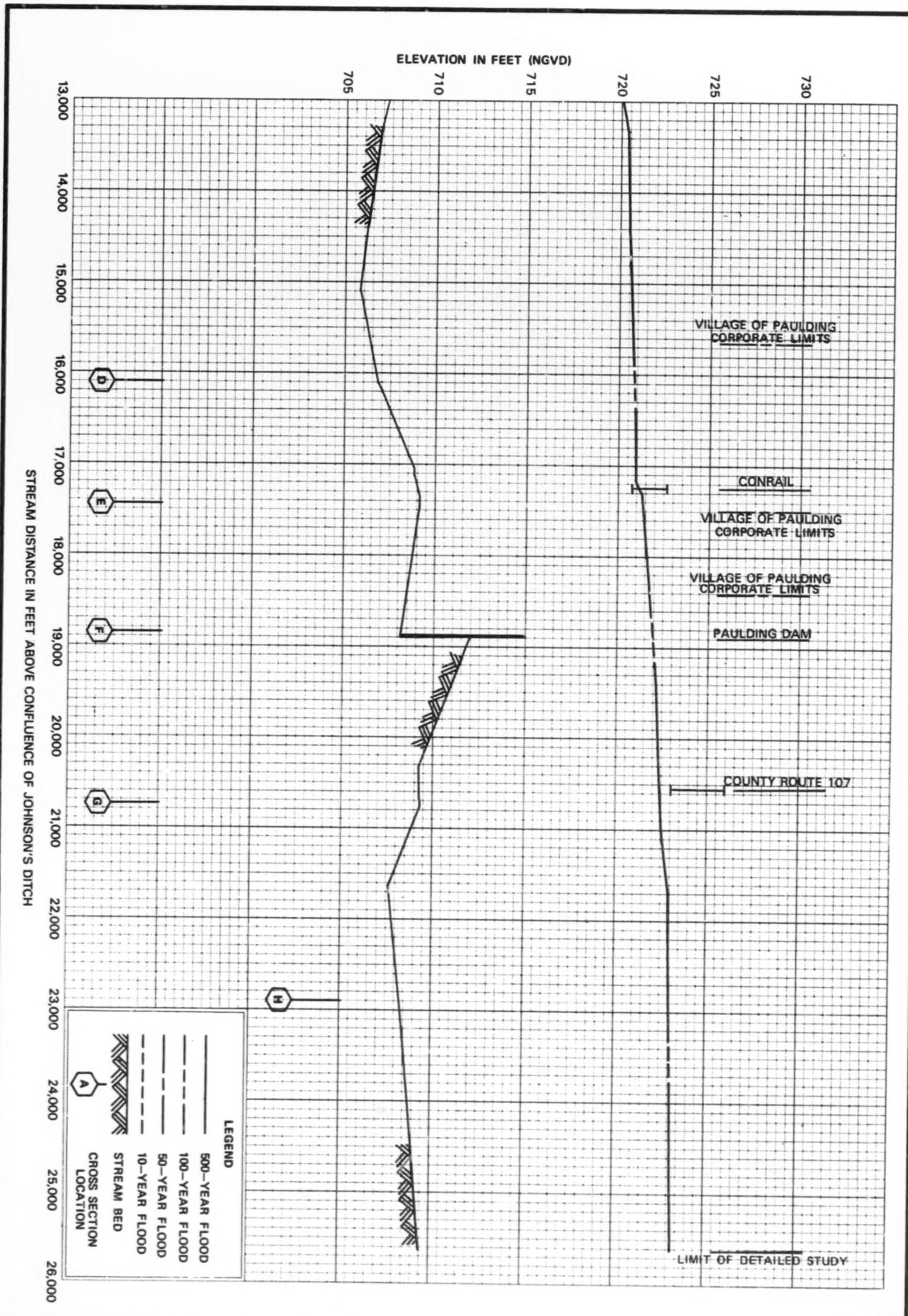
FLOOD PROFILES

FLATROCK CREEK

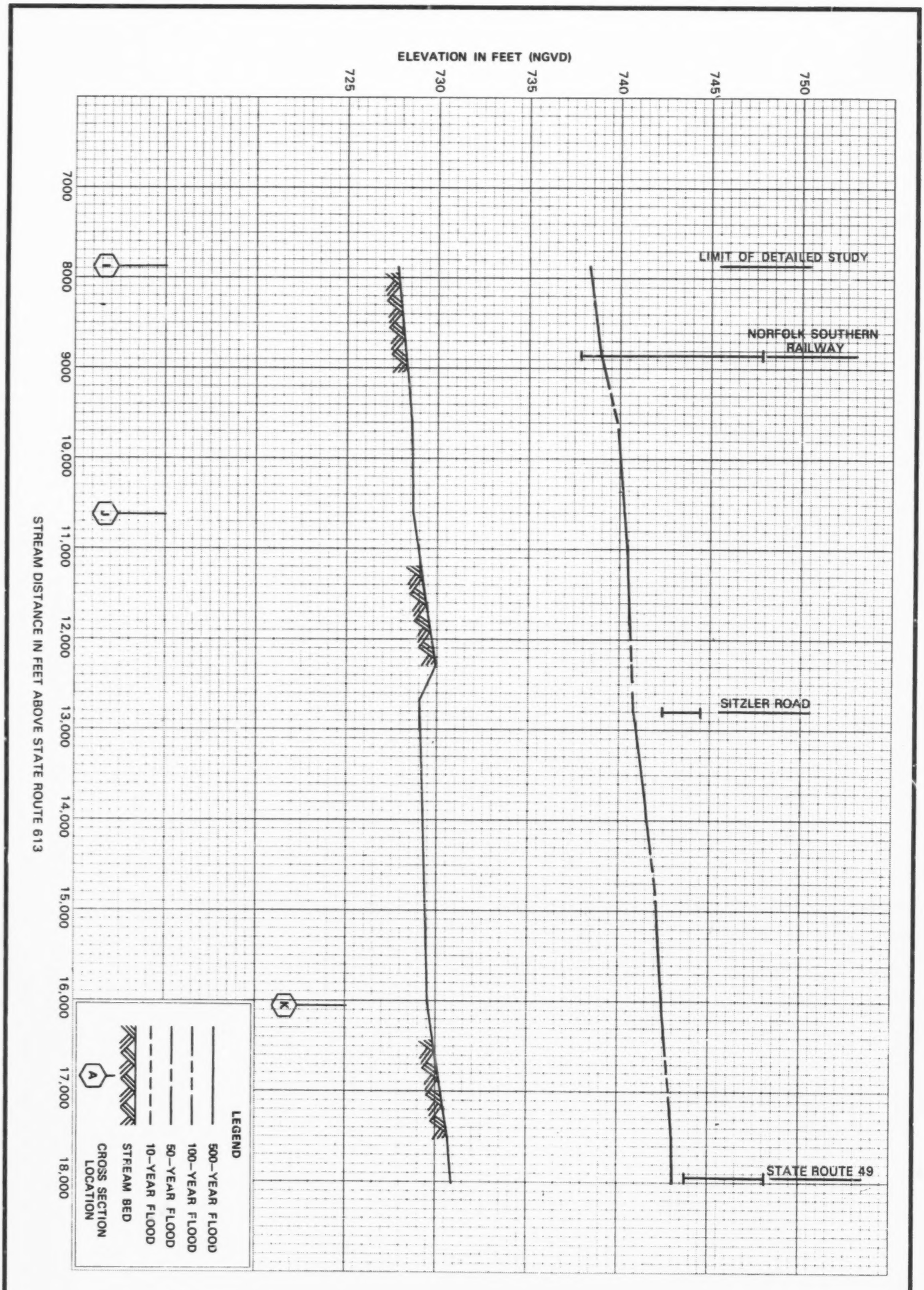
FEDERAL EMERGENCY MANAGEMENT AGENCY

PAULDING COUNTY, OH
(UNINCORPORATED AREAS)

02P



03P	FEDERAL EMERGENCY MANAGEMENT AGENCY **PAULDING COUNTY, OH** (UNINCORPORATED AREAS)	**FLOOD PROFILES** **FLATROCK CREEK**



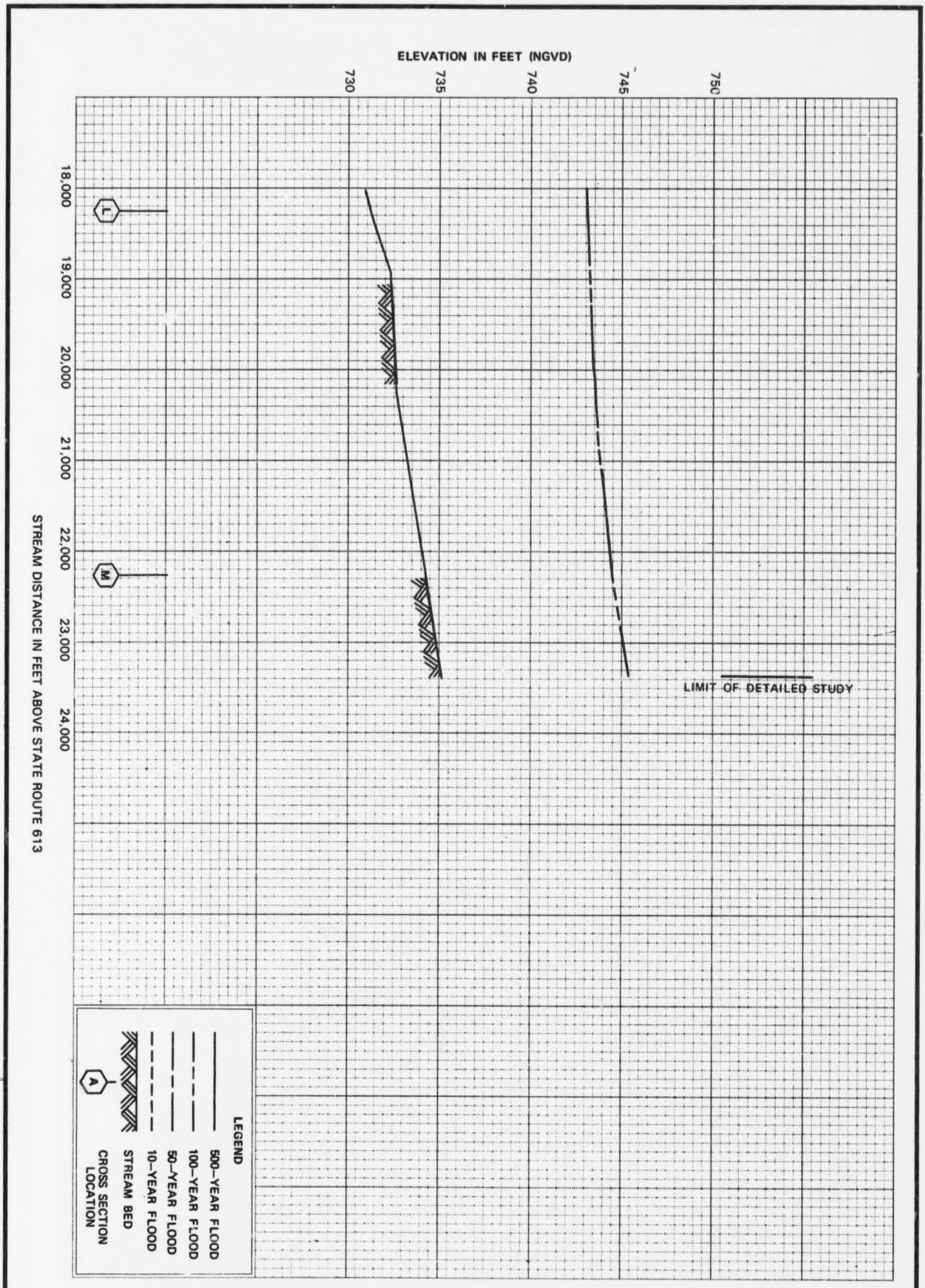
04P

FEDERAL EMERGENCY MANAGEMENT AGENCY

PAULDING COUNTY, OH
(UNINCORPORATED AREAS)

FLOOD PROFILES

FLATROCK CREEK



05P

FEDERAL EMERGENCY MANAGEMENT AGENCY

PAULDING COUNTY, OH
(UNINCORPORATED AREAS)

FLOOD PROFILES

FLATROCK CREEK